Leaf Shape Inheritance in Coleus

David C. Rife

Cultivated coleus (*Coleus blumei*) vary greatly in leaf shape as well as coloration. There are four major categories of variation in shape: deep versus shallow lobed margins, crinkly versus smooth, irregular versus regular, and narrow versus normal width.

A dominant gene (L) results in deep lobes, and also in complete male sterility. Another allele in this series results in deep lobes and male fertility (l^F), while a third allele (l) results in shallow lobes and male fertility (Rife, 1944).

A dominant gene (G) results in irregular leaves, a condition in which the leaf veins anastomose to form an oval area and the leaves tend to curl inward (Rife and Duber, 1946). Genes G and L interact to form very deeply lobed leaves, resembling those of watermelons. These genes are not linked.

Another dominant gene (C) results in a rough crinkly leaf surface, as opposed to the usual smooth flat surface (Rife, 1948).

The present report concerns the inheritance of narrow leaves, and relations between genes determining leaf width and other genes affecting leaf shape.

Materials and Methods

Seeds for narrow-leafed coleus were purchased from a commercial seed firm. They produced plants with leaves averaging 1/8-1/2 inches in width. They were vigorous and produced seeds within approximately three months.

Analysis of the inheritance of narrow leaves followed the usual procedure of obtaining F_2 and backcross ratios. The investigation also included tests for linkage and interactions of genes for narrow leaves with other genes affecting leaf shape.

Results

A plant from a pure breeding strain of narrow-leafed coleus was crossed with a normal leafed one from a pure breeding strain known as "Chartreuse". The F_1 progeny had narrow leaves. One of the F_1 plants was selfed and produced an F_2 ratio not deviating significantly from three with narrow to one with leaves of normal

TABLE 1

Results from crosses between narrow and normal (Chartreuse) varieties

Description	Observed		Expected		x^2	P
	Narrow	Normal	Narrow	Normal		
F_2	77	35	84	28	2.333	>0.10
Backcross	48	52	50	50	0.160	>0.50

TABLE 2

Chi-squared analysis of segregating progeny from selfed offspring of narrow × Purple cross to fit 13.3 ratio

Phenotypes	Observed	Expected
Normal	176	179.57
Narrow	45	41.53

$X^2 = 0.407$ $P > 0.50$

width. One of the F_1 plants was backcrossed to the Chartreuse parent resulting in an approximate 1:1 ratio of narrow versus normal-leafed offspring, thus indicating simple dominance of narrow leaves (Table 1).

F_2 progenies obtained from crosses of narrow-leafed plants with plants having irregular leaves and other plants having crinkly leaves gave ratios of approximately 9:3:3:1, indicating no linkage.

Quite different results were obtained from crossing a plant heterozygous for narrow leaves with one from a variety designated as Purple and having leaves of normal width. A total of 92 offspring was produced, all of which had leaves of normal width. Leaves of Purple were indistinguishable from those of Chartreuse in width. Sixteen of the 92 offspring were selfed, among which 7 produced both narrow and normal leafed offspring, in a ratio of approximately 13 normal to 3 narrow (Table 2). This is the expected ratio from selfing plants heterozygous for narrow, and also for a dominant inhibitor of narrow leaves. Presumably Purple carries the dominant inhibitor whereas Chartreuse does not. Mature narrow-leafed plants varied from some with extremely narrow leaves to others with leaves over 1/2 inch in width.

A plant heterozygous for narrow deep-lobed leaves was crossed with one having normal shallow-lobed leaves. Both plants were derived from Purple. Offspring occurred in a ratio not deviating

Fig. 1. Simply inherited variations in leaf shape. From left to right: normal, narrow, narrow irregular deep-lobed.

significantly from 3 normal shallow: 3 normal deep: 1 narrow shallow: 1 narrow deep. The greatest deviation was in the preponderance of narrow shallow over narrow deep, suggesting low viability of narrow deep-lobed plants. Otherwise the observed ratio conformed closely to the expected if the normal shallow-lobed parent was heterozygous for the dominant inhibitor (Table 3).

The narrow deep-lobed parent in the foregoing cross was later crossed with a normal shallow-lobed plant of the Chartreuse variety. Only 4 narrow deep-lobed plants occurred among 88 offspring,

TABLE 3

Test for 3:3:1:1 ratio segregation of Purple deep normal × Purple narrow

Phenotypes	Observed	Calculated
Normal shallow	44	37.75
Normal deep	39	37.75
Narrow shallow	14	12.25
Narrow deep	5	12.25

$X^2 = 6.310$ $P > 0.10$

whereas the other three phenotypes occurred in approximately equal numbers (29 normal shallow, 27 normal deep, 28 narrow shallow). Here again low viability of narrow deep-lobed plants is indicated. Taking this into account the observed ratio conforms to the expected when neither parent carries a dominant inhibitor.

An independent investigation by K. Shepherd (1969, personal communication) gave similar results, with the exception that two dominant inhibitor loci appeared to be present in his normal-leafed variety. The ratios of normal to narrow-leafed plants in the original segregating progenies did not conform to the expected 13 normal: 3 narrow, thus ruling out a single dominant inhibitor locus. The ratios did conform to what would be expected from the complementary action of two dominant inhibitors.

Summary

A dominant gene (N) is responsible for narrow leaves in coleus. A dominant inhibitor prevents its expression in one or more varieties, whereas the complementary action of inhibitors at two loci is indicated in another variety. No linkage is indicated between N and the genes responsible for deep lobes (L), irregular (G) and crinkly (C) leaves.

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Literature Cited

Rife, D. C. 1944. The inheritance of certain common variations in coleus. Ohio Jour. Sci., no. 1, pp. 18-24.

———. 1948. Simply inherited variations in coleus. Jour. Hered., no. 39, pp. 85-91.

Rife, D. C., and H. C. Duber. 1946. Genes and species differences in coleus. Jour. Hered., no. 37, pp. 327-330.

Department of Botany, University of Florida, Gainesville, Florida 32601.